eRD14: Beam test details

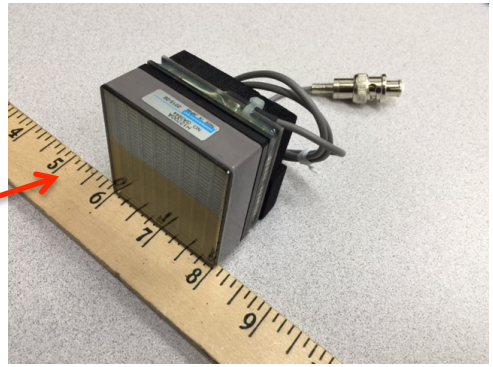
Q1: Please provide a complete diagram of the setup for the tests of the aerogel RICH detector.

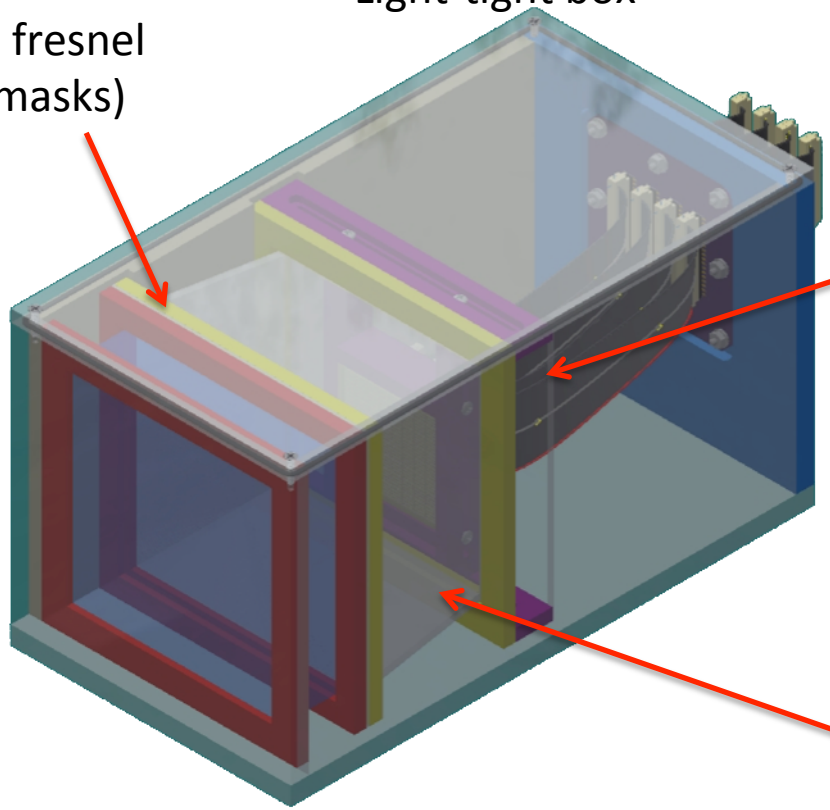
Test box

Readout with 1-4
H12700A MAPMTs

Light-tight box

We have a fresnel
lens (plus masks)



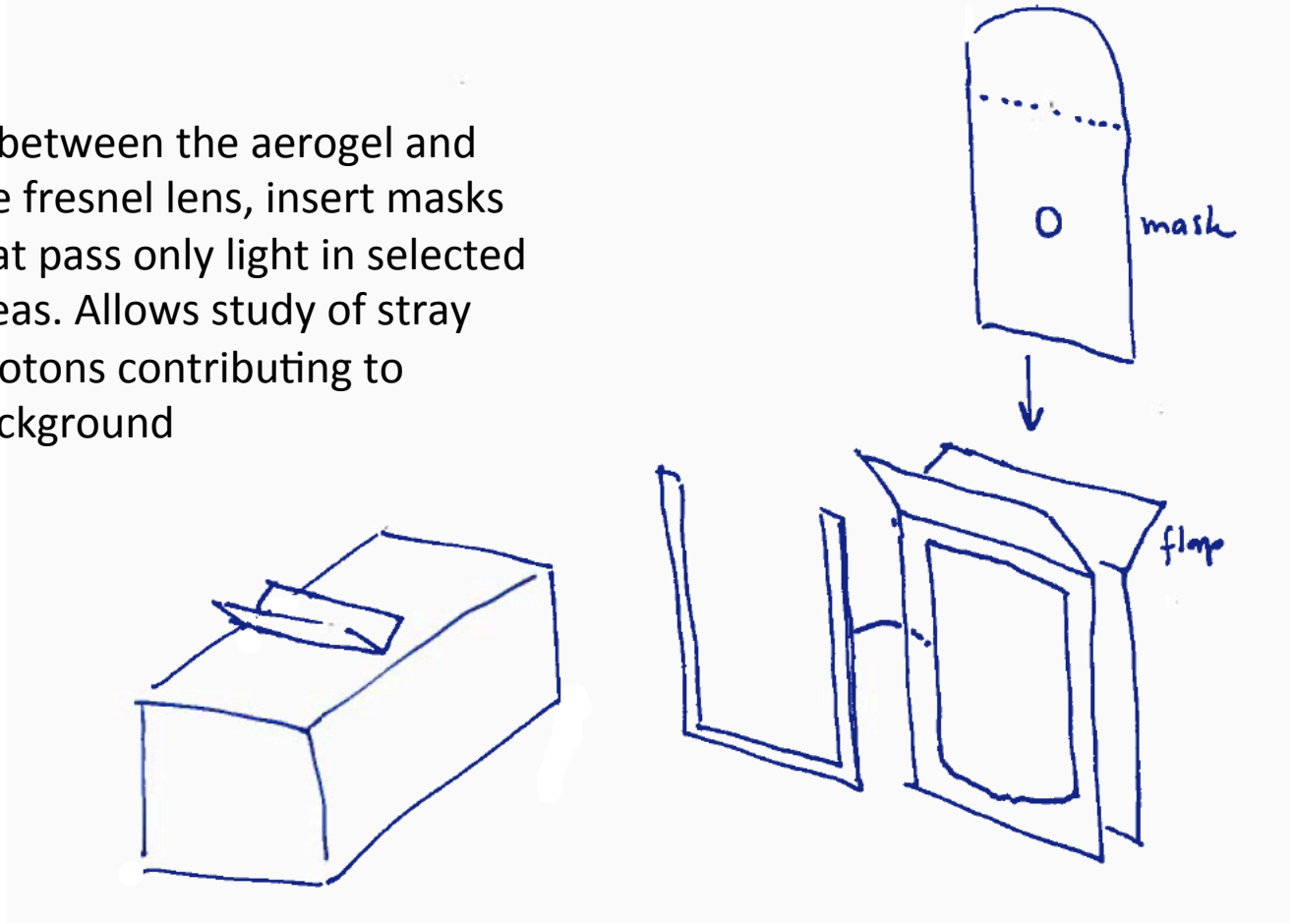


We have 3
aerogel blocks,
n=1.020 (2) and
n=1.050

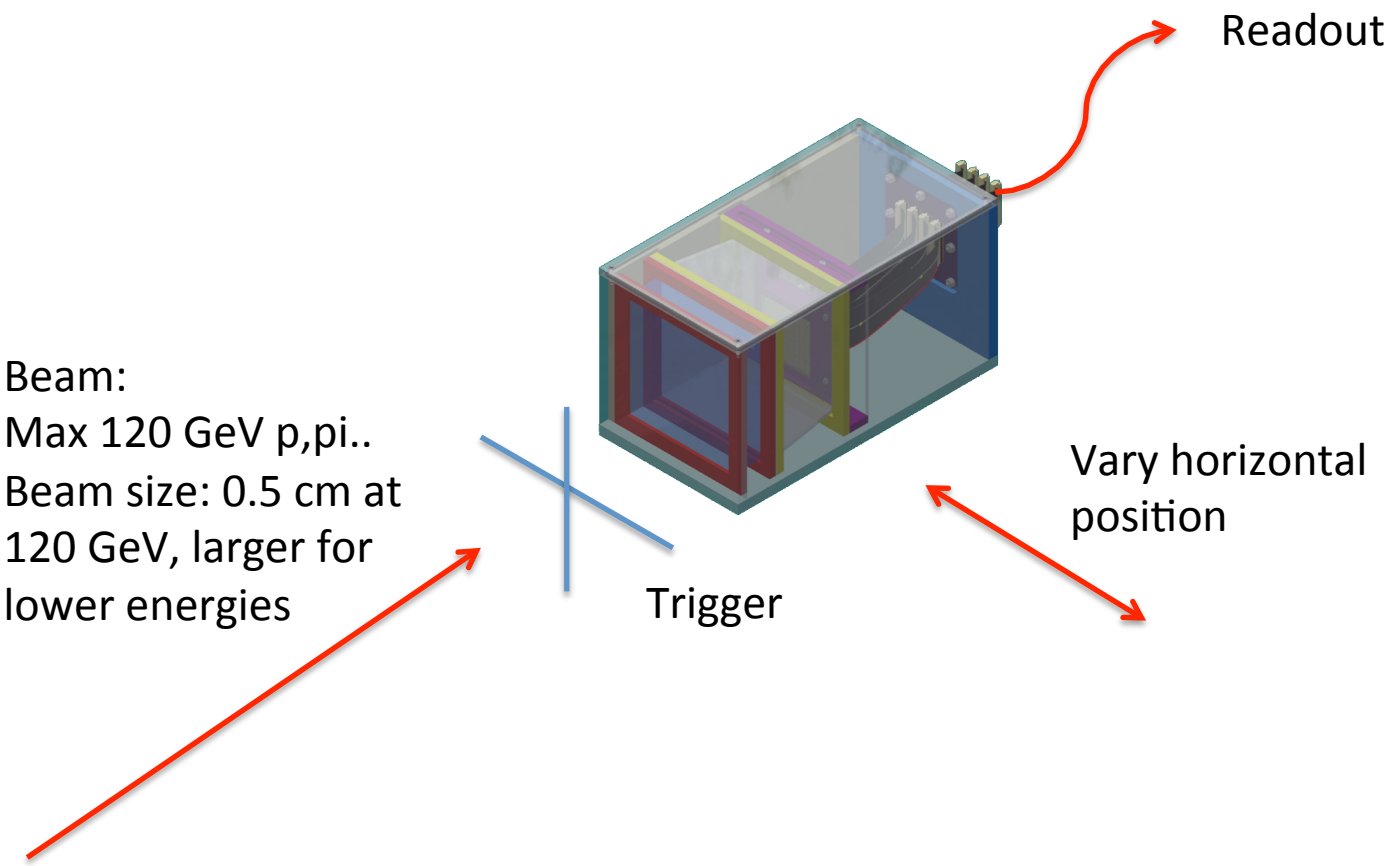
Mirror box, front
Face mirrors

Study stray photons

In between the aerogel and the fresnel lens, insert masks that pass only light in selected areas. Allows study of stray photons contributing to background



Test environment



Test beam properties

April 6 – May 3 2016

120 GeV

16 GeV

1 GeV

Energy	Mode[1]	Protons	Pions[2]	Highest Intensity[3]	Muons	Kaons	electrons	Spot Size[4]	Δp
120 GeV	Protons	100%	0	5E5	0	0	0	6mm	2%
60 GeV	pions +								
50 GeV	pions +								
40 GeV	pions +								
32 GeV	pions +/-			500,000					
30 GeV	pions +/-			500,000					
25 GeV	pions +/-			600,000					
20 GeV	pions +/-			500,000					
16 GeV	LEπ +/-		87%	1,000,000	100%			10mm	<4.5%
15 GeV	LEπ +/-								
12 GeV	LEπ –			500000					
10 GeV	LEπ +/-								
8 GeV	LEπ +/-		55%	750,000	98%			12mm	2.3%
6 GeV	LEπ +								
4 GeV	LEπ +/-		31%	400,000	74%			13mm	2.7%
3 GeV	LEπ +/-								2.7%
2 GeV	LEπ +/-		<30%	450,000				13mm	
1 GeV	LEπ +/-		<30%	69,000					2.7%

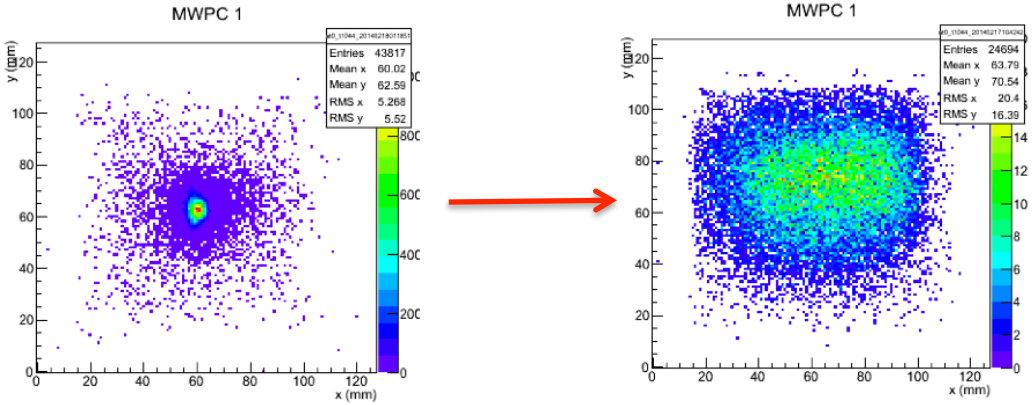
RMS of beam spot

6mm

10mm

13mm

Measured last year:

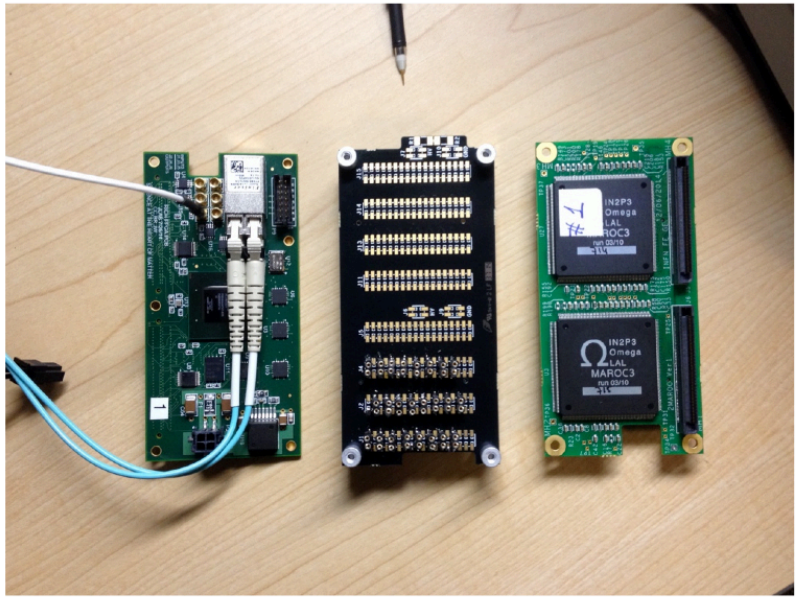


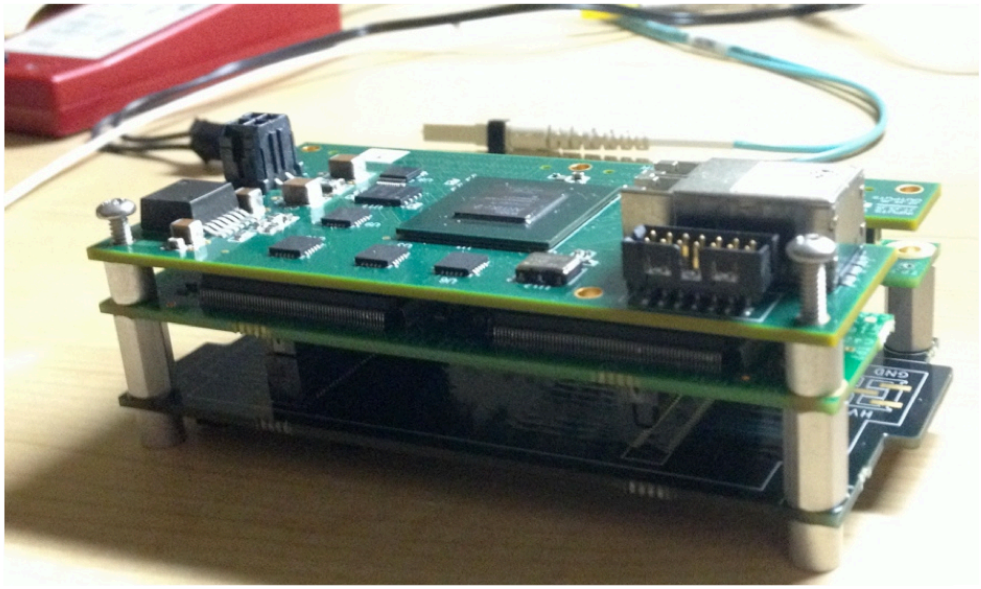
Beam size mm to cm, so we will have trigger fingers

Readout:

RICH MAPMT Assembly

- The CLAS12 RICH detector will use compact front end unit (Tile) to readout the MAPMTs
- A tile is composed by three boards: MAPMTs Adapter, ASIC board and FPGA board
- Complete tessellation of the electronics panel requires 2 variants:
  - 2 MAPMT/2 MAROC/128 pixel (100 mm x 50 mm)
  - 3 MAPMT/3 MAROC/192 pixel (150 mm x 50 mm)
- Four prototypes have been produced in October 2014

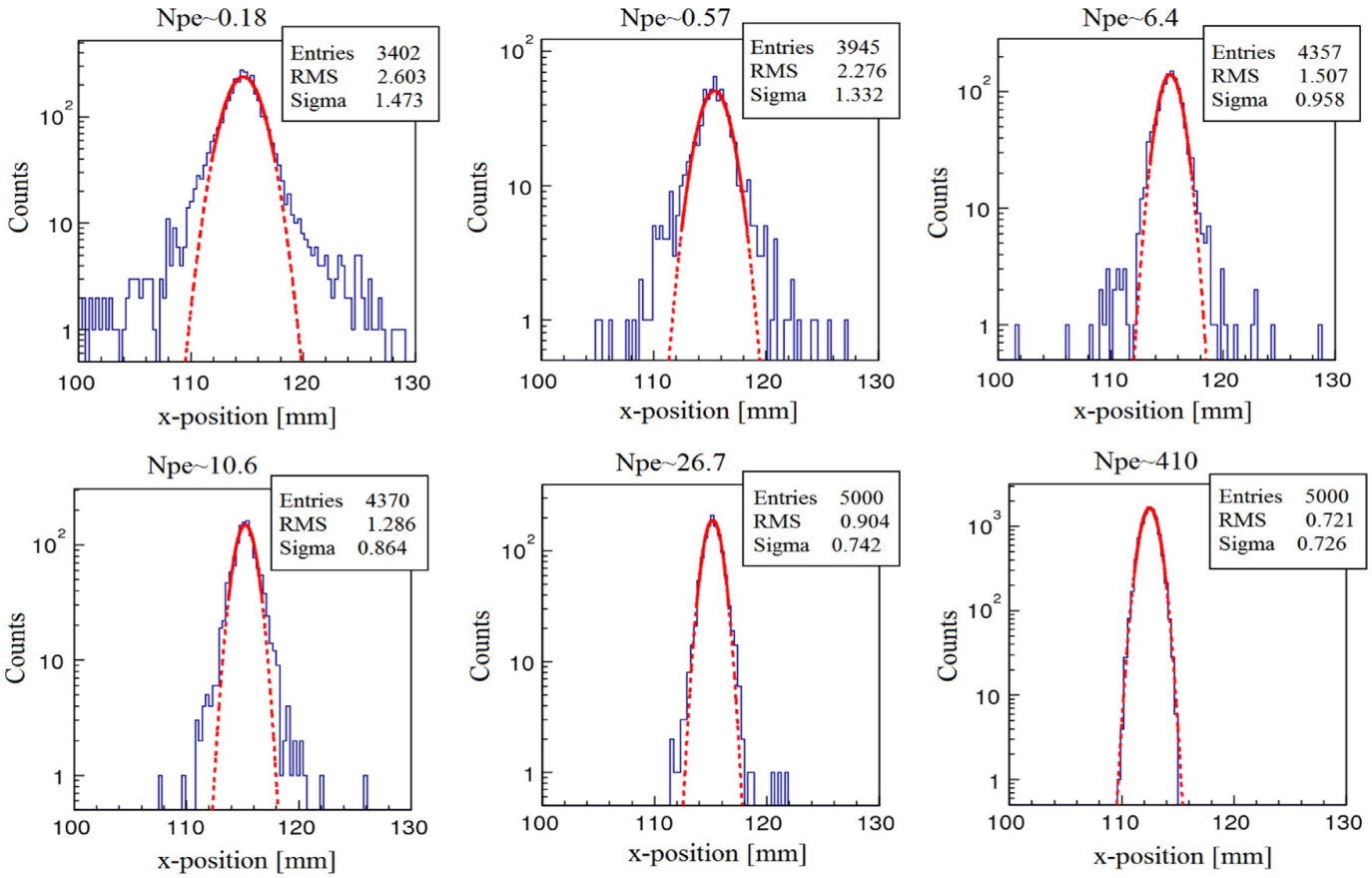




eRD14: LAPPD resolution

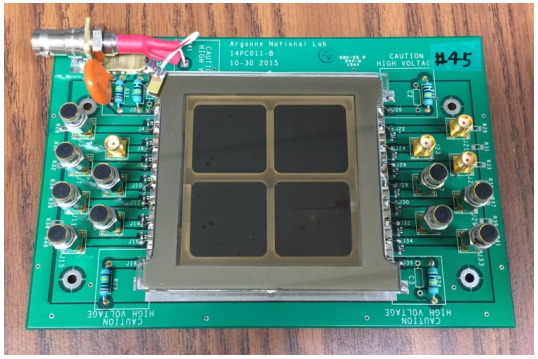
Q2: What is the position resolution of the LAPPD photodetectors in single p.e. mode.

LAPPD position resolution at different photoelectron modes

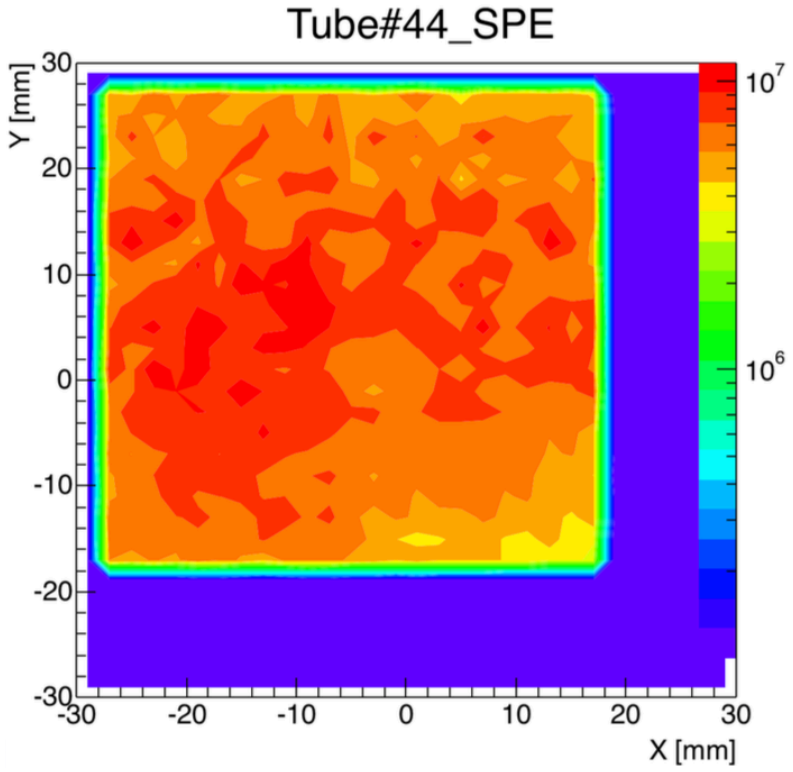


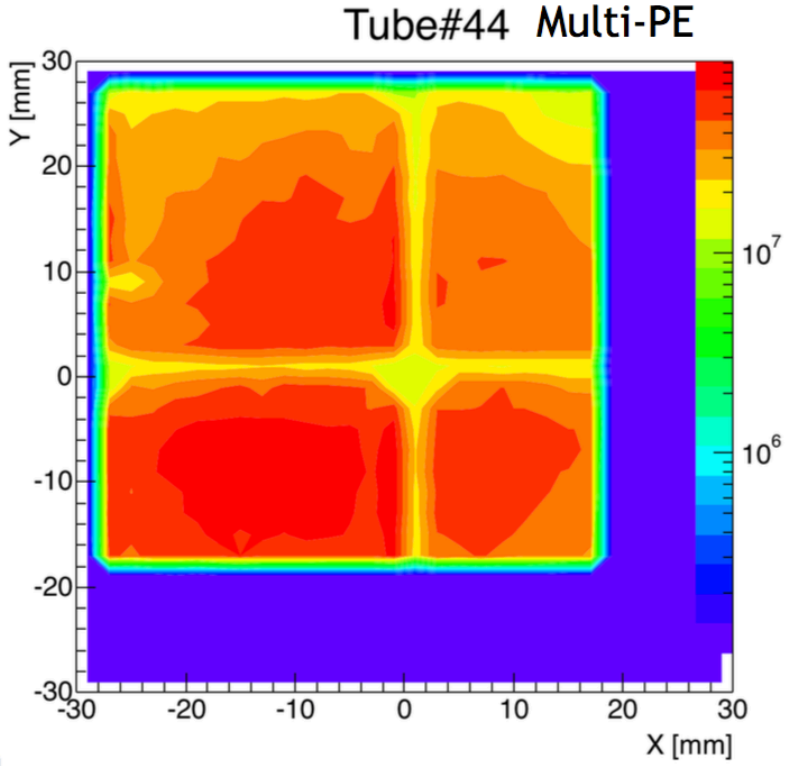
Position resolution of the detector is strongly dependent on the signal-to-noise ratio. The small signals form a wide distribution, while the large signals form a narrower distribution.

LAPPD SPE Mapping Scan and Issues



- Left figure is the absolute gain map measured in single PE mode, but the result is contaminated by the scattered photons.
- Right figure is a map of the number of the collected electrons, measured in multi-PE mode. It shows the overall uniformity of the tube. It is a combination of the QE, collection efficiency and gain uniformities. We use this method to measure the overall response uniformity, as a diagnose tool to tell if there are problems with the tube.





LAPPD SPE Mapping Scan and Issues

- In single-PE mode, the signal of the direct incident photon is contaminated by the scattered photons. No matter where the laser spot is, the tube is always able to detect the scattered photons, which makes the gain look “more uniform”. For example, even the laser spot is on the spacer, the tube gives a good pulse due to the scattered photon somewhere else. In this case, the spacer is indistinguishable in the 2D gain map.
- In multi-PE mode, the pulses produced by the main laser beam is much higher than that produced by the scattered photons, which reveals the spacers in the 2D map.